Pasir Ris Crest Secondary School

December Holiday Assignment 2025

Secondary 2G2 Mathematics

Teacher In-charge : Ms Maslinda Malik

Name:_____(_____)   Class:_____

No.	Topic	Duration
1	Algebra: Expansion and Simplification	30 mins
2	Algebra: Factorisation and Algebraic Fractions	30 mins
3	Algebra: Simultaneous Equations	30 mins
4	Volume and Surface Area of 3D Solids	30 mins
5	Problems in Real World Context	30 mins
6	3A Chapter 1: Algebraic Expressions and Formulae 1. Go to SLS and click on "2NA December Holiday Homework" 2. Go to the page for "Task 6" 3. Watch the videos and complete the questions on SLS before attempting the questions.	30 mins

Instructions:

1. Relevant videos for the revision topics can be found in SLS under the title Videos for Nov/Dec Holiday Assignment.

2. Complete the tasks on <u>foolscap paper</u>.

3. Questions with * are optional.

Deadline: <u>First Mathematics Lesson in 2026</u>

Task 1: Algebra (Expansion and Simplification)

Part I: Expansion using Distributive Law

$a(b+c) = ab+ac$	$(a+b)(c+d) = a(c+d)+b(c+d)$ $= ac+ad+bc+bd$
$-(x+y) = -x-y$	$-(x-y) = -x+y$

1* Expand and simplify each of the following algebraic expressions.

(a)	$-(10-4x)$	**(b)**	$8(p+3q)-25q$
(c)	$3(x+2)-2(x+1)$	**(d)**	$(2x-7)(3x+1)$

2* Expand and simplify each of the following algebraic expressions.

(a)	$-3x(6x+y)$	**(b)**	$-2(3b-c)-5b$
(c)	$-2x-9(3x-7y)$	**(d)**	$5(x+1)-(x-2)$
(e)	$(7a-8)(a-2)$	**(f)**	$3a-(2a+1)(1-3a)$

Part II: Expansion using special algebraic identities

$(a+b)^2 = a^2 + 2ab + b^2$	$(a-b)^2 = a^2 - 2ab + b^2$	$(a-b)(a+b) = a^2 - b^2$

3* Expand and simplify each of the following algebraic expressions.

(a) $(3x+4y)^2$	**(b)** $(3q-8r)^2$
(c) $(2t+11)(11-2t)$	**(d)** $(2a+3)^2 - (a+4)(a-4)$

4* Expand and simplify each of the following algebraic expressions.

(a) $(9h+2k)^2$	**(b)** $(9q-5p)^2$
(c) $(9r-5q)(5q+9r)$	**(d)** $(2x-3)^2 + 4x(1-x)$

(e) $(2a+3)^2 - 3a(1-a)$	(f) $(5x-7y)(5x+7y)-(x-2y)^2$

5 Expand and simplify the following expressions.

 (a) $-5h(7-4h)$

 (b) $2j(3a-2c)$

 (c) $-7k(9c-2d)$

6 Expand and simplify the following expressions.

 (a) $4-x(2x+1)$

 (b) $(x+2y)(5x-y)$

 (c) $(2y-1)(y-7)-9y$

 (d) $4y-(y+1)(y-3)$

7 Expand and simplify the following expressions using special algebraic identities.

 (a) $\left(\dfrac{1}{4}p+7\right)^2$

 (b) $(p-q)^2 - 6(p+5q)^2$

 (c) $(5y-8)(5y+8)$

 (d) $\left(2y-\dfrac{1}{3}x\right)\left(2y+\dfrac{1}{3}x\right)$

Task 2: Algebra (Factorisation)

Part I: Factorisation Using Common Factor

1* Factorise the following expressions completely.

(a) $15h + 15k$	**(b)** $6c + 24m$

2* Factorise the following expressions completely.

(a) $2p - 8$	**(b)** $3a^2 - 6a$
(c) $5ab^2 - 125bc$	**(d)** $4a^2b + 18ab^3$

Part II: Factorisation of Quadratic Expressions-Multiplication Table

Step 1: Find the factors of the term in x^2.

Step 2: Find the factors of the constant term.

Step 3: Place the term in x^2 and the constant term into their respective positions.

Step 4: Through trial and error, place the factors in various positions within their respective columns and multiply to see which combination's result is equal to the term in x.

Step 5: Check the answer.

e.g. $x^2 + x - 6 = (x - 2)(x + 3)$

$$\begin{array}{c|cc} \times & x & +3 \\ \hline x & x^2 & 3x \\ -2 & -2x & -6 \end{array}$$

$3x + (-2x) = x$

3* Factorise the following expressions completely.

(a) $\quad x^2 - 2x - 15$	(b) $\quad p^2 + 10p - 24$

4* Factorise the following expressions completely.

(a) $\quad 2q^2 + q - 1$	(d) $\quad 4e^2 - 15e + 11$
(g) $\quad 5x^2 - 15 - 20$	(h) $\quad -2x^2 - 7y + 4$

Part III: Factorisation using Special Identities

$(a+b)^2 = a^2 + 2ab + b^2$	$(a-b)^2 = a^2 - 2ab + b^2$	$(a-b)(a+b) = a^2 - b^2$

5*   Factorise the following expressions completely.

(a) $a^2 + 10a + 25$	**(b)** $a^2 - 12a + 36$
(c) $a^2 - 100$	

6*   Factorise the following expressions completely.

(b) $81h^2 + 18hk + k^2$	**(d)** $100 - 20c + c^2$
(e) $49h^2 - 9$	

Part IV: Algebraic Fractions . <mark>(suggest change to N level type qn, can get from TYS for this segment, keep to 10 questions in total)</mark>

Multiplication and Division of Algebraic Fractions

(1)   The value of a fraction remains unchanged if both its numerator and denominator are multiplied or divided by the same non-zero number or expression,

$$\frac{a}{b} = \frac{a \times c}{b \times c} \qquad \text{and} \qquad \frac{a}{b} = \frac{a \div c}{b \div c}$$

where b ≠ 0 and c ≠ 0.

(2)   When we multiply $\dfrac{a}{b}$ by $\dfrac{c}{d}$, we have:

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$, where b ≠ 0 and d ≠ 0.

(3)   When we divide $\dfrac{a}{b}$ by $\dfrac{c}{d}$, we have:

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$, where b, c, d ≠ 0.

7*   Simplify each of the following.

Simple multiplication and division.	
(a) $\dfrac{4ab^2}{15c^2d} \times \dfrac{10c^3d}{8ab}$	**(b)** $\dfrac{7p^3q}{3r^2s^5} \div \dfrac{14q^2r^3}{6ps^3}$

Factorise first, then perform the multiplication or division.	
(c) $\dfrac{x^2-4y^2}{x^2+5xy}\times\dfrac{2x+10y}{3x-6y}$	(d) $\dfrac{x^2+7x+12}{x^2-36}\div\dfrac{x+4}{x+6}$

8* Simplify each of the following.

(a) $\dfrac{3a}{4b}\times\dfrac{8b^2}{9a^3}$	(b) $\dfrac{5a^3b}{6yz^2}\times\dfrac{36z}{25a^2b^3}$
(c) $\dfrac{2x+5}{3x-2}\times\dfrac{15x-10}{2x}$	(d) $\dfrac{18x^2+18x+4}{x^2-2x+1}\times\dfrac{x^2-1}{18x^2-2}$
(e) $\dfrac{35xy^3}{15yz^2}\div\dfrac{14x^2z}{6y^2z^3}$	(f) $\dfrac{121-y^2}{a^2-y^2}\div\dfrac{y-11}{y+a}$

9   Factorise the following expressions completely.

    (a) $27p + 63q - 108r$

    (b) $8ay - 24by + 40cy$

10   Factorise the following expressions completely.

    (a) $w^2 - 13w + 36$

    (b) $y^2 - 4y - 21$

    (c) $z^2 - 12z + 32$

    (d) $u^2 + 3u - 130$

11   Factorise the following expressions completely.

    (a) $a^2 + 22a + 121$

    (b) $d^2 - 14d + 49$

    (c) $4y^2 - 9$

12   Factorise the following expressions completely.

    (a) $-3j^2 + 18j + 21$

    (b) $9k^2 + 36k + 36$

    (c) $54m^2 - 6$

13   Simplify the following algebraic fractions.

    (a) $\dfrac{6x + 9}{2xy + 3y}$

    (b) $\dfrac{6y^2 - 8y + 2}{2y - 2}$

    (c) $\dfrac{x^2 - 4}{5x^2 + 20x}$

    (d) $\dfrac{d^2 - 5d + 6}{3(d - 2)} \times \dfrac{d - 3}{d}$

    (e) $\dfrac{2r^2 - 4r - 6}{r - 3} \div \dfrac{r^2}{2}$

Task 3 Simultaneous Equations

Part I: Elimination method
- Ensure that the numerical values of the coefficients of one variable in both equations are the same
  - To do so, multiply one equation OR
  - Multiply both equations to get the lowest common multiple
- If both coefficients have the same sign (both positive or both negative), subtract one equation from the other
- If both coefficients have different signs (one positive, one negative), add both equations together

1* Solve the following simultaneous equations.

(a) $3x + y = 5$ ----- (1)   *y* has the same numerical coefficient in both equations.
$x + y = 3$ ----- (2)   Both signs are positive, subtract: (1) – (2)

(b) $7x - 2y = 17$ ----- (1)   Both *x* and *y* do not have the same numerical coefficient in both equations.
$3x + 4y = 3$ ----- (2) $4y$ in (2) is a multiple of $2y$ in (1).
Multiply (1) by 2 to get the same numerical coefficient of *y*: (1) × 2

(c) $7x - 3y = 18$ ----- (1)   Both *x* and *y* do not have the same numerical coefficient in both equations.
$6x + 7y = 25$ ----- (2)   None of the numerical coefficients is a multiple of another.
Multiply (1) and (2) to get the lcm .

2*	**(a)** $2x + 3y = 5$ $2x + 7y = 9$	**(b)** $11x + 4y = 12$ $9x - 4y = 8$
	(c) $9x - 5y = 2$ $3x - 4y = 10$	**(d)** $7x + 3y = 8$ $3x - 4y = 14$

Part II: Substitution Method
- Express one variable in terms of the other variable
- Substitute this expression into the other equation

3*   Solve the following simultaneous equations.

(a) $x + y = 7$ ----- (1)
       $x = 5 + y$ ----- (2)

     x is expressed in terms of y ($x =$ _____)
     substitute (2) into (1)

(b) $5x + 3y = 11$ ----- (1)
       $4x - y = 2$ ----- (2)

     both variables are not expressed in terms of the other variable
     since y has a numerical value of 1, express y in terms of x: rearrange (2)

(c) $2x + 5y = 12$ ----- (1)
       $4x + 3y = -4$ ----- (2)

     both variables are not expressed in terms of the other variable
     choose a variable to be expressed in terms of the other variable: x in (1)
     rearrange (1) to express x in terms of y

4*

(a)

$$y = 5 - 2x$$
$$3x - y = 0$$

(b)

$$5x + 2y = 3$$
$$x - 4y = -6$$

(e)

$$3x + 7y = 2$$
$$6x - 5y = 4$$

(f)

$$2y - 5x = 25$$
$$4x + 3y = 3$$

Part III: Real-world Contexts <mark>(remove all the optional qn here)</mark>

- Formulate a pair of linear equations

5*   Angie has $30.

If she buys 6 granola bars and 2 boxes of cereal, she will receive $0.40 in change.
If she buys 4 granola bars and 3 boxes of cereal, she will be short of $0.40.

Given that the cost of each granola bar is $x and the cost of each box of cereal is $y, find the price of each item.

6*   5 candles and 3 bath bombs cost $136.
8 candles and 18 bath bombs cost $268.

Given that the cost of each candle is $x and the cost of each bath bomb is $y, find the price of each item.

7* Raju has $15.
If he buys 8 pears and 5 mangoes, he will be short $2.60.
If he buys 5 pears and 4 mangoes, he will receive $2.60 in change.

Given that the cost of each pear is $x and the cost of each mango is $y, find the price of each item.

8 Solve the following simultaneous equations.

$$x + 2y = 21$$
$$5x + 3y = 49$$

**9** Solve the following simultaneous equations.

$$4x - 3y = 8$$
$$2x - y = 5$$

10 The cost of a pair of pants is $ p, and the cost of shirt is $ q.
5 pairs of pants and 6 shirts cost $201
3 pairs of pants and 2 shirts cost $87
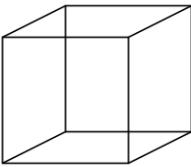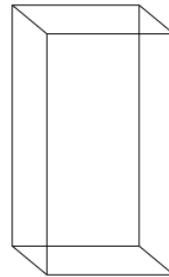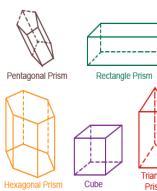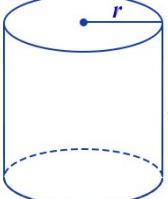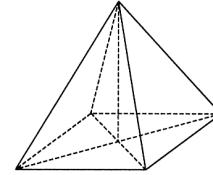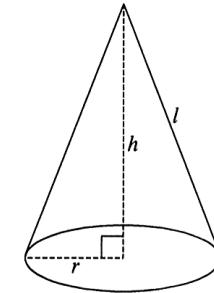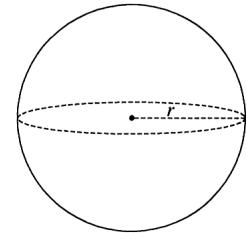
(a) Write down a pair of simultaneous equations in terms of p and q.
(b) Solve the simultaneous equations.

11 The mass of a book is m kg and the mass of a magazine is n kg.
The mass of 3 books and 4 magazines is 5.6 kg.
The mass of 2 books and 5 magazines is 4.9 kg.
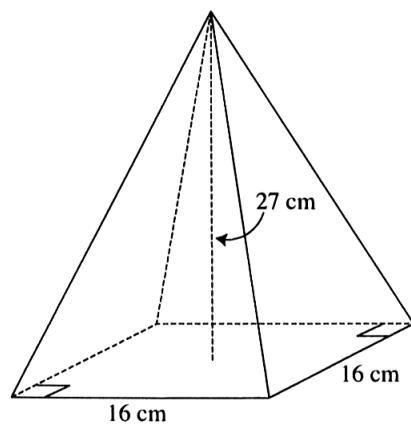
(a) Write down a pair of simultaneous equations in terms of m and n.
(b) Hence, find the mass of 1 book and 1 magazine respectively.

Task 4: Volume and Surface area of 3D solids
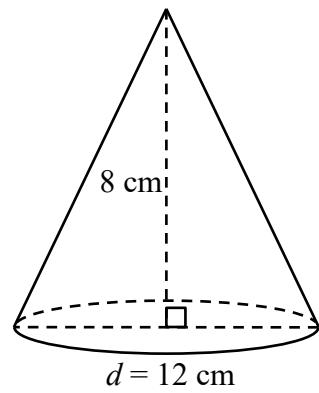
Name	Cube	Cuboid	Prism	Closed Cylinder	Pyramid	Cone	Sphere
Figure							
Volume	l^3	$l \times b \times h$	base area × height	$\pi r^2 h$	$\frac{1}{3}$ × base area × height	$\frac{1}{3}\pi r^2 h$	$\frac{4}{3}\pi r^3$
Total Surface Area	$6\,(l^2)$	2 (lb) + 2 (bh) + 2 (lh)	perimeter of base × height + 2 × base area	$2\pi rh + 2\pi r^2$	base area + area of all lateral faces	$\pi rl + \pi r^2$	$4\pi r^2$

1* Find the **volume** and **total surface areas** of the following figures, giving your answer to 3 significant figures if needed.

(a)

27 cm

16 cm

16 cm

(b)

8 cm

$d = 12$ cm

(c)

$d = 14$ cm
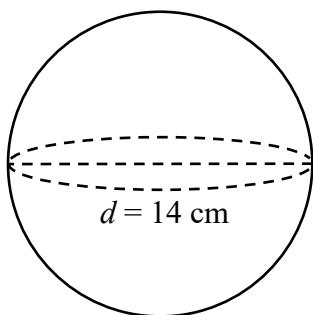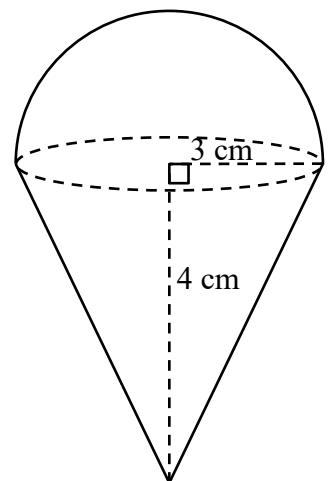
2* Find the **volume** and **total surface area** of the following figure giving your answer to 3 significant figures if needed.

3* A glass figurine is in the shape of a pyramid. Given that it has a volume of 42 cm^3 and a base area of 8 cm^2, find the height of the figurine.

4* The volume, V cm^3, of a right circular cone has a base radius r cm and a height h cm. Complete the table.

	Radius, r cm	Height, h cm	Volume, V cm^3
(a)	8		320
(b)		11	695

5* Find the radius and the surface area of a sphere with volume 34 cm^3.

Word Problems

6* Figure 1 below shows a closed cylinder that is half-filled with water. The diameter of the cylinder is 28 cm and the length is 50 cm. Leave all your answers in terms of π.

28

50

Figure 1

20

30
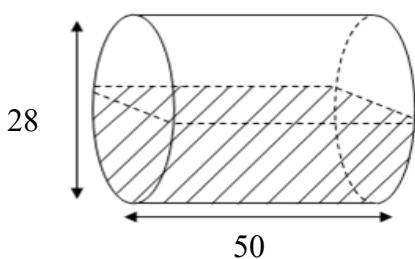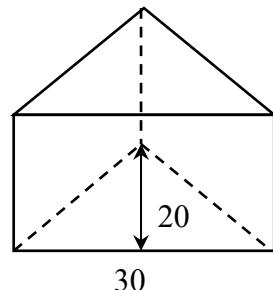
Figure 2

**(a)** Show that the volume of water in the cylinder is 4900π cm^3.
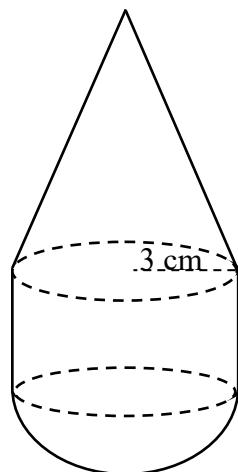
(b) Calculate the surface area of the cylinder in contact with the water.

Water from the cylinder is then poured into a triangular prism, as shown in Figure 2. The base of the triangular prism has a length of 30 cm and a perpendicular height of 20 cm.

(c) Find the height of the water level in the prism in centimetres.

7*   The diagram shows a model made up of a cone, a cylinder and a hemisphere.
The base radius of the cone is 3 cm and the volume of the cone is 132 cm^3.

     (a)   Calculate the height of the cone.

     (b)   Hence calculate the slant height of the cone.

     (c)   Given that the ratio of the volume of the hemisphere to the volume of the cylinder is 2 : 5, calculate the height of the cylinder.

     (d)   If the cost of painting the model is $0.45 per cm^2, find to the nearest dollar, the total cost of painting the model.

Remove Q8 to 10
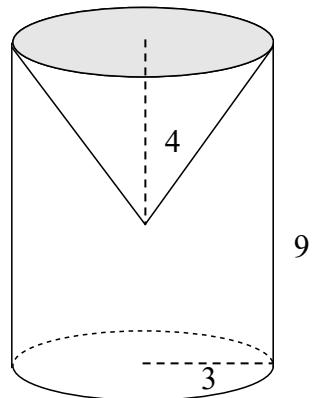
8   A cylinder has a base radius of 3 cm and height 9 cm.

(a)   Find the volume of the cylinder.

A cone of height 4 cm is inscribed into the cylinder to form a new solid.

(b)   Calculate the percentage decrease in volume when the cone is inscribed.
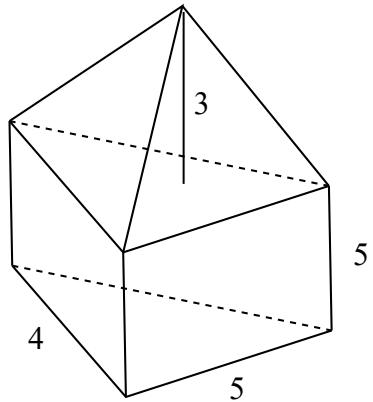
(c)   Find the total surface area of the new solid.

9   A solid made of a prism of height 5 cm and a pyramid of height 3 cm. The pyramid an prism has a right-angled triangular base.

(a)   Calculate the area of the triangular base.

(b)   Calculate the volume of the solid.

10   A water tank is modelled after a cylinder and a hemisphere. The cylinder has a base radius of 5 m and a height of 8 m.
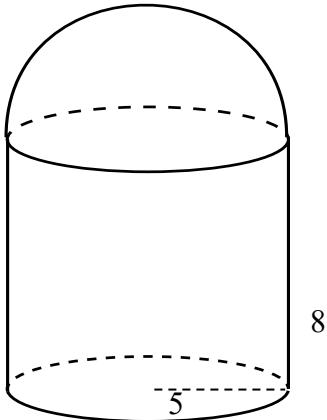
(a)   Find the volume of the water tank in m^3.

The water tank will be made out of aluminium at a cost of $2.58 per m^2.

(b)   Find the material cost to construct the water tank. Give your answer to the nearest dollar.

Task 5: Problems in Real-World Context

1 The Body Mass Index (BMI) is a measure of the ideal weight for your height.

$$\text{BMI} = \frac{\text{mass (kg)}}{\text{height (m)}\times\text{height (m)}}$$

A person who has high BMI is considered overweight and has high health risk.
The table below shows the relationship between BMI and the health risk.

BMI (kg/m²) for Adults	Weight Categories	Health Risk
< 18.5	Underweight	Increased Risk
18.5 – 24.9	Normal weight	Least Risk (Healthy range)
25.0 – 29.9	Overweight	Moderate Risk
≥ 30	Obese	High Risk

(a) Given that Adam is 180 cm tall and weighs 70 kg, calculate his BMI in kg/m².

(b) Belle is 160 cm tall and weighs 75 kg. Find the minimum weight she must lose in order to be within the healthy range of the BMI.

(c) **(i)** The heaviest person in Guinness Book of World Records weighs an estimated weight of 635 kg. Calculate his/her height when his/her BMI was 186 kg/m².

(ii) In a healthy weight loss program, a person should not lose more than 10% of his/her weight over 6 months. Calculate the weight of that heaviest person after 3 years. State one assumption you have made.

2   Jack owns a car of engine capacity of 1300 cc. He usually drives about 11 000 km per year in his car

His car travels 13 km on every litre of petrol.
Petrol currently costs $2.32 per litre.

(a)   Estimate how much Jack spends on petrol per year.
Give your answer to the nearest dollar.

The road tax for a car is calculated in dollars based on its engine capacity.

Engine capacity (y) in cc	Annual road tax formula ($)
$y \leqslant 600$	200×1.564
$600 < y \leqslant 1000$	$[200 + 0.125 \times (y - 600)] \times 1.564$
$1000 < y \leqslant 1600$	$[250 + 0.375 \times (y - 1000)] \times 1.564$
$1600 < y \leqslant 3000$	$[475 + 0.75 \times (y - 1600)] \times 1.564$
$y > 3000$	$[1525 + 1 \times (y - 3000)] \times 1.564$

(b)   Use the relevant formula to calculate the annual road tax that Jack must pay.
Give your answer to the nearest dollar.

In addition to petrol and road tax he estimates that he will have these extra costs each year:

- Insurance normal price * $2360
- Road Pricing charge (ERP) $920
- Servicing and other maintenance $1050
- Parking $880

* The insurance company reduces the normal price by 30% because he has not made a claim

Jack estimates that, if he did not have a car, he would have all these monthly travel costs:

- MRT $50
- Bus $55
- Taxis $375

(c)   Would it be cheaper for Jack to use other transport instead of his car? Show workings to support your answer.

(From 2016 N Levels Paper 2 Q10)

Task 6: Algebraic Expressions and Formulae (Sec 3A Chap 1)

A. Factorisation of by grouping

View the SLS lesson package to watch the video on factorisation by grouping.

Worked Example 2:

Factorise $3x + 3 + xy + y$

Solution:

- Step 1: Identify the common factors by forming two groups.
- Step 2: Factorise each group
- Step 3: Take out common factor

$$3x + 3 + xy + y$$
$$\text{Step 1} \quad = (3x+3) + (xy+y)$$
$$\text{Step 2} \quad = 3(x+1) + y(x+1)$$
$$\text{Step 3} \quad = (x+1)(3+y)$$

.

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1 Factorise the following completely:

(a) $-36bc + 4bd$

(b) $-12p - 27q$

(c) $18y^2 - 6y$

(d) $-a^3 - 2a^2$

2 Factorise the following completely:

(a) $4a(3-x) + 7(3-x)$

(b) $y(3x+4) - (3x+4)$

(c) $ax + bx + ay + by$

(d) $ab - bx + 2ay - 2xy$

(e) $6ax + 12by + 9bx + 8ay$

(f) $x + xy + 2y + 2y^2$

Answer Key

Task 1		
5	**(a)**	$-35h + 20h^2$
	(b)	$6aj - 4cj$
	(c)	$-63kc + 14kd$
6	**(a)**	$-2x^2 - x + 4$
	(b)	$5x^2 + 9xy - 2y^2$
	(c)	$2y^2 - 24y + 7$
	(d)	$-y^2 + 6y + 3$
7	**(a)**	$\dfrac{1}{16}p^2 + \dfrac{7}{2}p + 49$
	(b)	$-5p^2 - 62pq - 149q^2$
	(c)	$25y^2 - 64$
	(d)	$4y^2 - \dfrac{1}{9}x^2$

Task 2		
9	**(a)**	$9(p + 7q - 12r)$
	(b)	$8y(a - 2b + 5c)$
10	**(a)**	$(w - 9)(w - 4)$
	(b)	$(y + 3)(y - 7)$
	(c)	$(z - 8)(z - 4)$
	(d)	$(u - 10)(u + 13)$
11	**(a)**	$(a + 11)^2$
	(b)	$(d - 7)^2$
	(c)	$(2y + 3)(2y - 3)$
12	**(a)**	$-3\,(j - 7)(j + 1)$
	(b)	$9(k + 2)^2$
	(c)	$6(3m + 1)(3m - 1)$
13	**(a)**	$\dfrac{3}{y}$
	(b)	$3y - 1$
	(c)	$\dfrac{x - 4}{5x}$
	(d)	$\dfrac{(d - 3)^2}{3d}$
	(e)	$\dfrac{4(r + 1)}{r^2}$

Task 3		
8		$x = 5$, $y = 8$
9		$x = \dfrac{7}{2}$, $y = 2$
10		$p = 15$, $q = 21$
11		Book weigh 1.2 kg, magazine weigh 0.5 kg

Task 4		
8	**(a)**	254 cm^3
	(b)	14.8%
	(c)	245 cm^2
9	**(a)**	10
	(b)	60
10	**(a)**	890 m^3
	(b)	$1256

Task 5		
1	**(a)**	21.6
	(b)	11.256
	(c)	1.85 m
	(d)	337 kg
2	**(a)**	$1963
	(b)	$567

Task 6		
1	**(a)**	$4b(-9c + d)$
	(b)	$-3(4p + 9q)$
	(c)	$6y(3y - 1)$
	(d)	$-a^2(a - 2)$
2	**(a)**	$(4a + 7)(3 - x)$
	(b)	$(y - 1)(3x + 4)$
	(c)	$(x + y)(a + b)$
	(d)	$(b + 2y)(a - x)$
	(e)	$(3x + 4y)(2a + 3b)$
	(f)	$(x + 2y)(1 + y)$